Syed Mamun Raihan

LEAD ENGINEER

Summary of Skills

- 15 years of industry and research experiences, C/C++ is core expertise
- *Object oriented design*, *meta-programming*, *design patterns*, Boost/STL
- Motivated, passionate, adaptable
- Uses Scrum/Agile/XP methodologies
- Comfortable with gdb/gcc and Visual Studio
- Brain bench C++ Ranking 88%, score 3.88 (#8120314)
- Working knowledge of *SQL* 92, Object Oriented Databases
- Working knowledge of Python, Matlab, UML 2.0, Tcl/Tk

Summary of Work and Education

- B.Sc. in EEE from Bangladesh University of Engineering & Technology
- M.Sc. in Computer Engineering from University of Central Florida
- 2 years of PhD Research and Study (incomplete) from University of Western Ontario
- 4/2009 to Current – Working for Ciena Inc. (Ciena is a major optical networking supplier for ATT and Verizon). Working in Software Defined Networking. My presentation involves my work related with Open flow.

Experiences (Highlights)

- 4/2008 to 2/2009 – Worked for Algorithmics Inc. (a IBM company). Worked in Basel 1 and Basel 2 portfolio risk assessment tools based on Risk++ (a C++ component library developed for financial industry including central banks).
- 5/2007 to 2/2008 – Worked for Nortel (Enterprise Division). Designed and developed pro-active voice quality monitoring systems. Used visual studio for windows client development and phone client using JTAG.
- 1/2003 to 4/2004 – Worked for North South University as a Lecturer. Taught C++/Programming Languages, Advance Database concepts in undergraduate classes.
- 5/2000 to 11/2001 – Worked for Spike Broadband Inc.. Worked on SNMP/CLI management application using C.

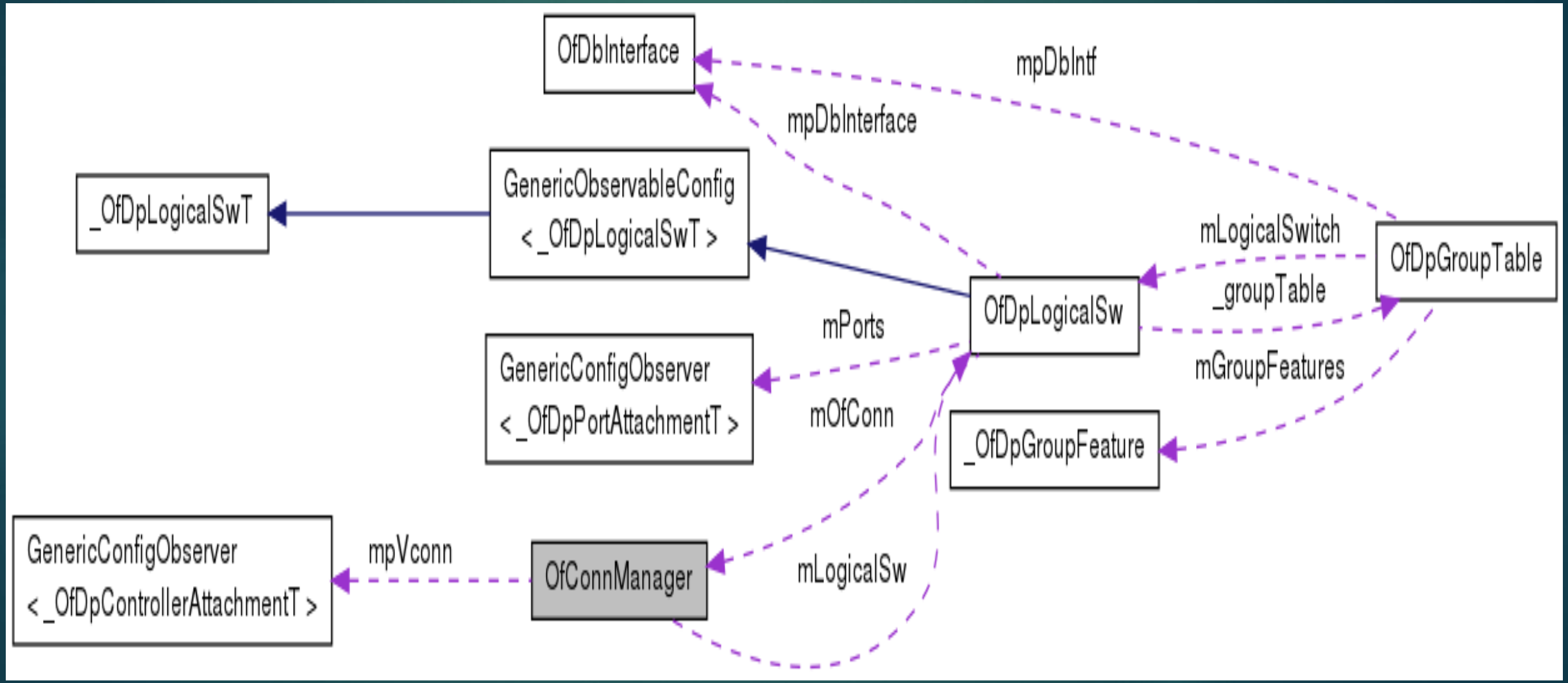
Software defined networking

- SDN approach in Ciena is Open flow driven. See (https://www.opennetworking.org/)
- Open Networking Foundation (ONF) is a user-driven organization dedicated to the promotion and adoption of Software-Defined Networking (SDN) through open standards development.
- Open flow Standard Specification covers the components and the basic functions of the network switch, and the OpenFlow protocol to manage an OpenFlow switch from a remote controller.
- I have implemented network front end for a switch and controller.
- I have contributed specification and platform independent switch core logic to support Flows, Groups, Queues.
- I have implemented Open flow switch configuration API and contributed Rest API interface to OF-CONFIG-API.

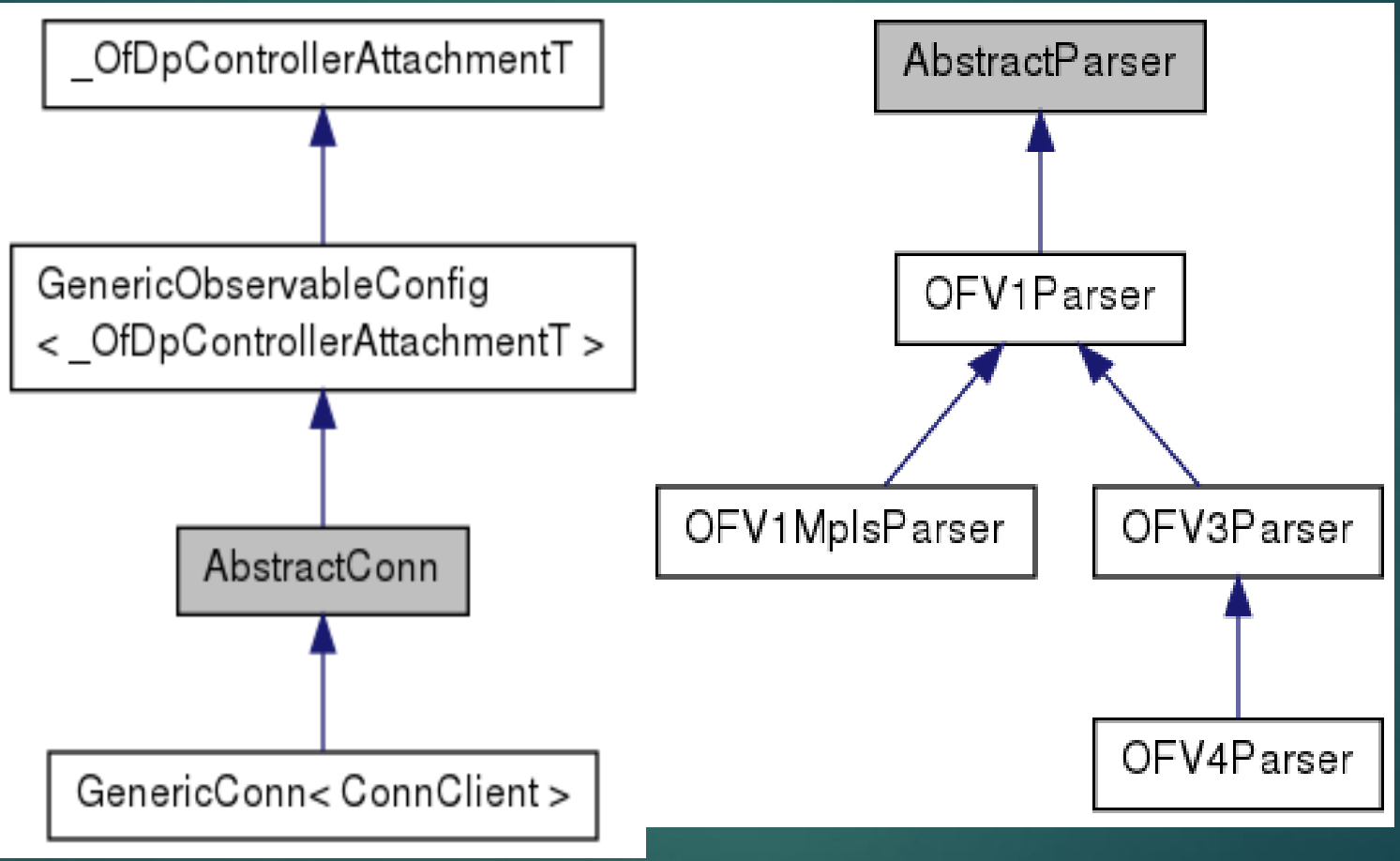
OF Switch Design Considerations

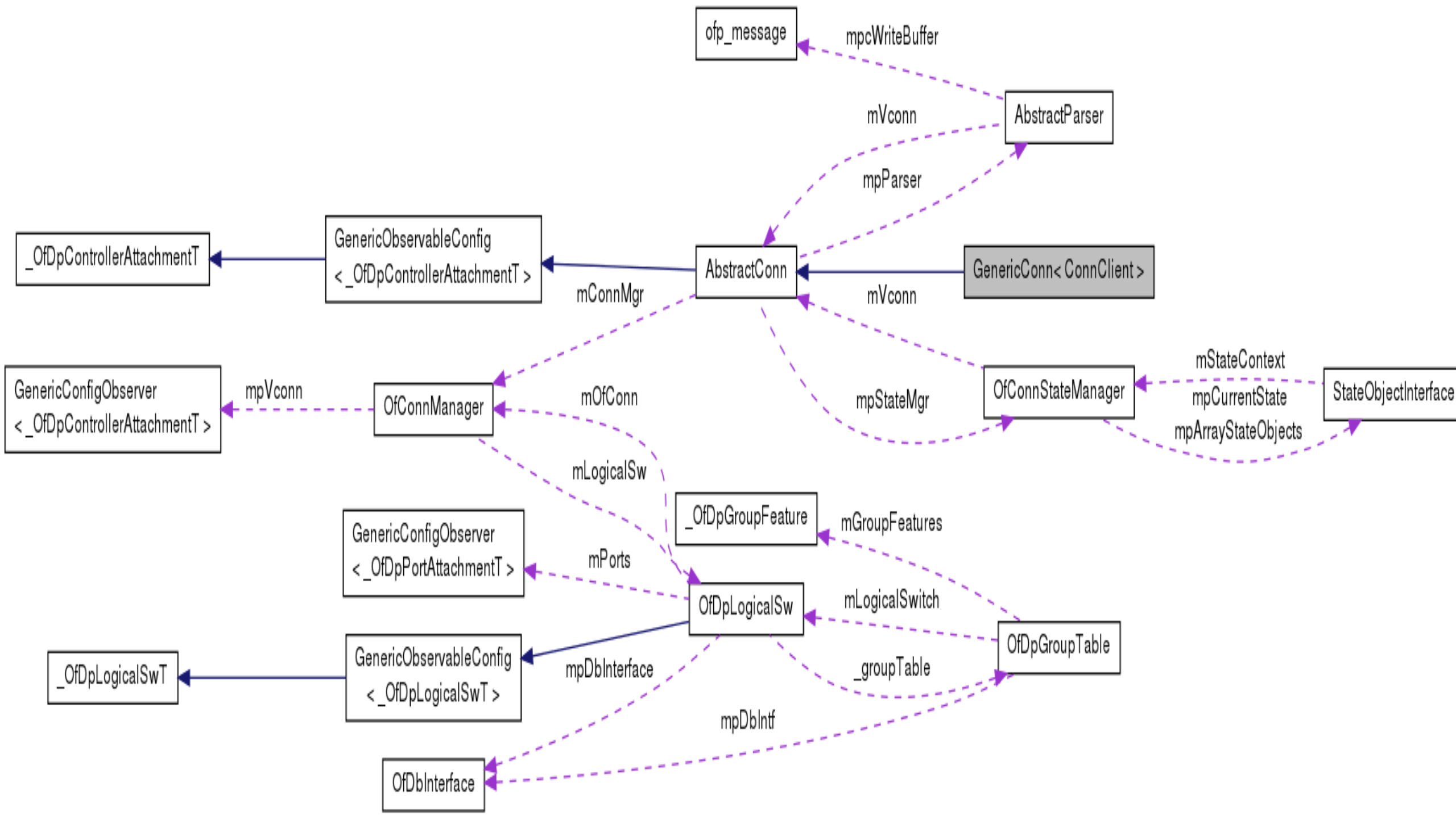
- Must support multiple OF Spec. Currently officially supports 1.0 and 1.3.
- Must support multiple connection mechanism. Currently support TLSv1 and TCP connections.
- Must support alternate configuration mechanism. Work in progress.
- Data plane API must support multiple HW platforms. Work in progress.
- Observer, Decorator, Proxy, Singleton, State, Virtual Constructor, Factory Method, Memento and Visitor patterns have been used or work in progress
- Doxygen Documents available for code walk.

Open flow Connection Manager

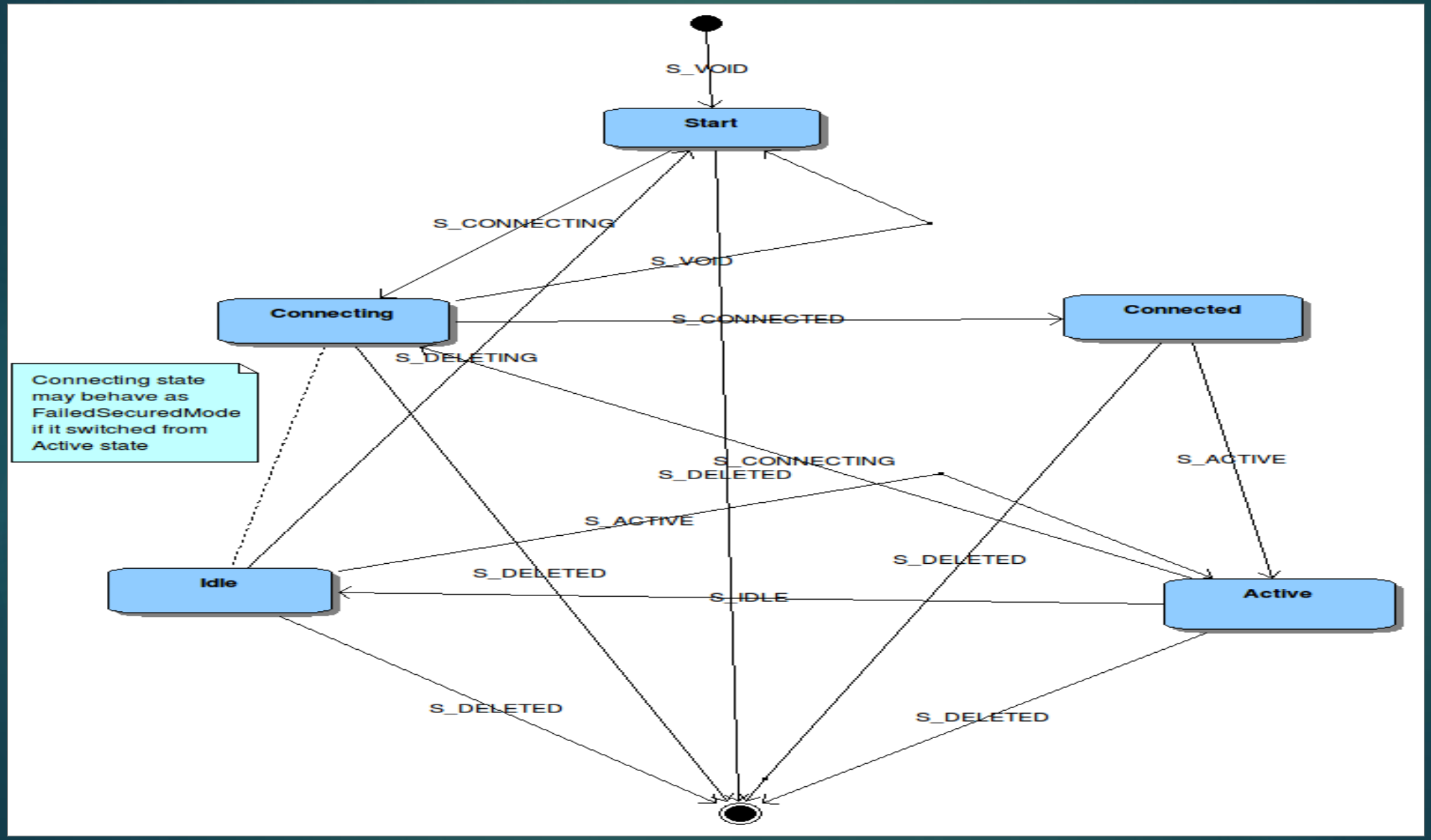


Abstract Connection / Parser

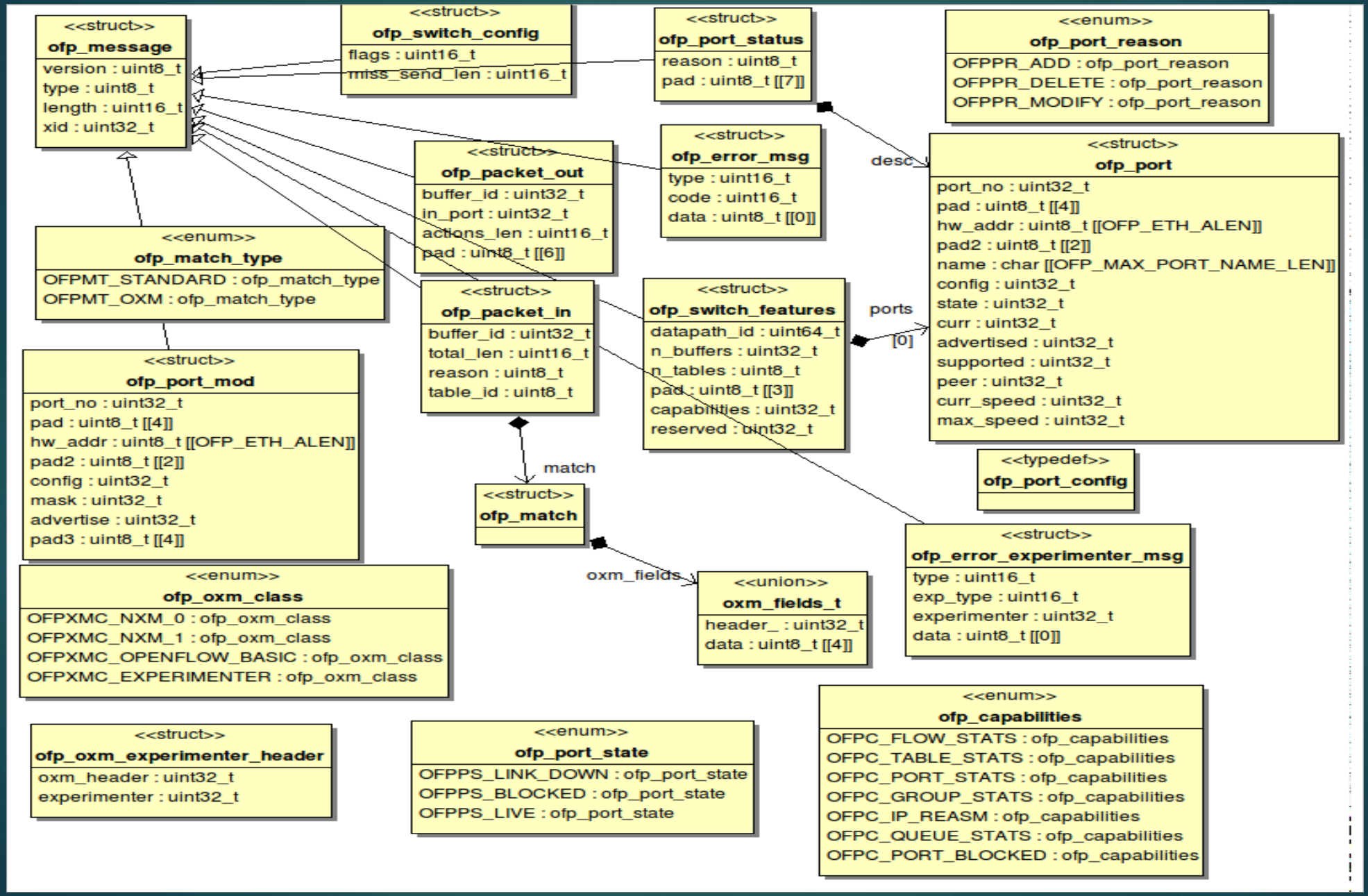



ofp_message
mpcWriteBuffer
AbstractParser
mVconn
mpParser
_OfDpControllerAttachmentT
GenericObservableConfig
< _OfDpControllerAttachmentT >
AbstractConn
GenericConn< ConnClient >
mConnMgr
mVconn
GenericConfigObserver
< _OfDpControllerAttachmentT >
mpVconn
OfConnManager
mOfConn
mpStateMgr
OfConnStateManager
mStateContext
mpCurrentState
mpArrayStateObjects
StateObjectInterface
mLogicalSw
_OfDpGroupFeature
mGroupFeatures
GenericConfigObserver
< _OfDpPortAttachmentT >
mPorts
OfDpLogicalSw
mLogicalSwitch
OfDpGroupTable
_OfDpLogicalSwT
GenericObservableConfig
< _OfDpLogicalSwT >
mpDbInterface
_groupTable
mpDbIntf
OfDbInterface

Connection State Machine

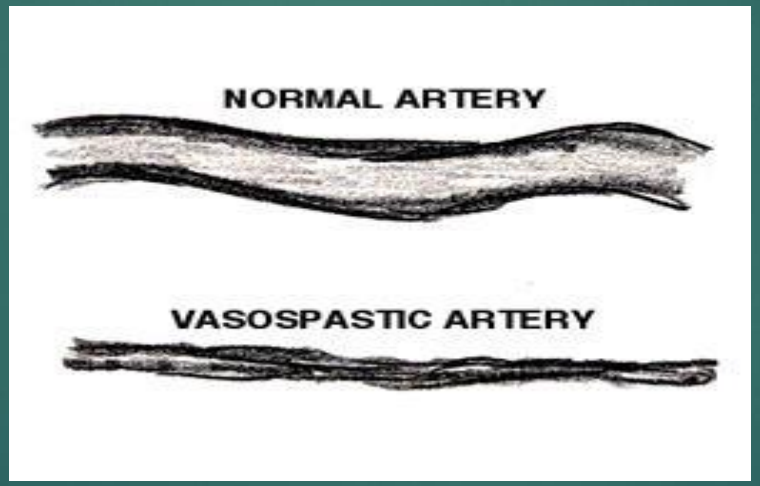


Sample external data model for switch and controller



Detection of Vasospasm in Comatose Patients Using EEG Spectral Characteristics (C++/matlab)

- About 30,000 cases of Subarachnoid Hemorrhage‡
  - 20,000 develop detectable vasospasm
  - 10,000 will become symptomatic
  - 60% suffer death or disability



- Treatment is possible if detected early

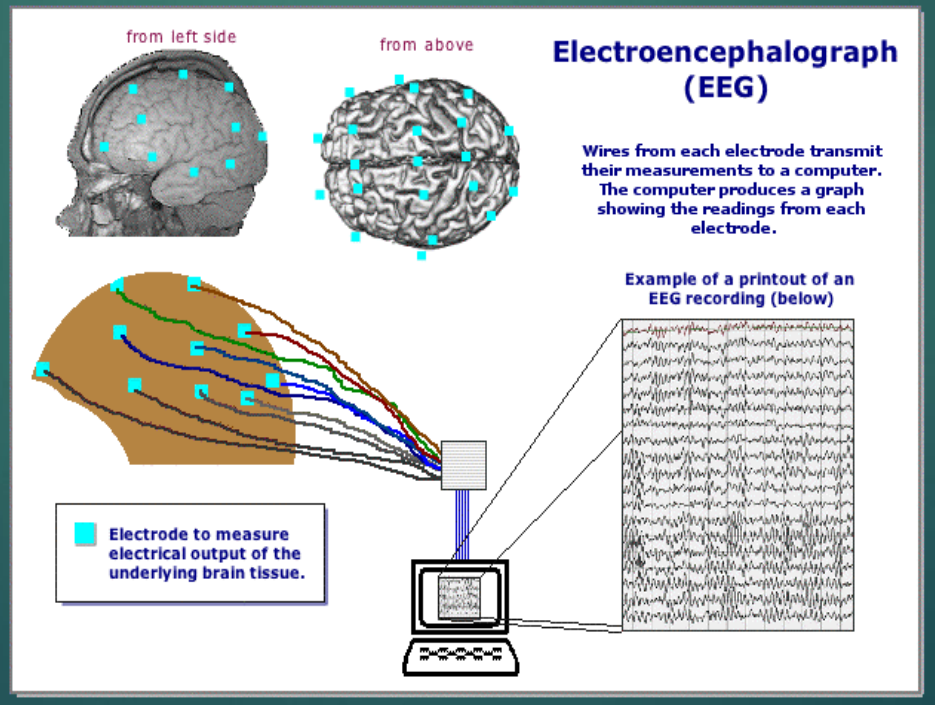
‡ Heiserman JE, "MR Angiography for the Diagnosis of Vasospasm after Subarachnoid Hemorrhage. Is It Accurate? Is It Safe?", American Journal of Neuroradiology 21:1571-1572 (2000)

- Current modes of detection -

- Transcranial Doppler or angiography are used
  - Neurological symptoms appear late
  - May result in late detection
- Current Role of EEG in monitoring vasospasm
  - Can record EEG continuously for days
  - Qualitative analysis of EEG requires specialized skills
  - May result in late detection

- Objective -

- To design and evaluate an algorithm for <u>automatic</u> detection of vasospasm from EEG data
  - using quantitative features extracted from EEG spectral characteristics
  - using autoregressive (AR) modeling



‡

‡ Courtesy of: http://web.lemoyne.edu/~hevern/psy340/lectures/psy340.09.02.stages.sleep.html

- AUTOREGRESSIVE (AR) MODELLING -

- AR model is based on parametric modelling in which each value in a time series is predicted from the past values

$$x_t = -\sum_{m=1}^{p} A_m x_{t-m} + e_t$$

where x_t is time series at time t,

x_{t-m} is the m^{th} previous value,

A_m are the AR model coefficients, and

e_t is zero mean white noise

- High resolution spectrum -

- Spectral power estimation using AR model

$$S_f = \frac{\sigma^2 T}{\left| \sum_{m=0}^{p} A_m e^{(-j 2\pi fm)} \right|^2}$$

where S_f is power at frequency f,

σ^2 is the variance for a particular model order p,

T is the length of the time series, and

A_m is the m^{th} coefficients of the time series

- SPECTRAL FLATNESS RATIO -

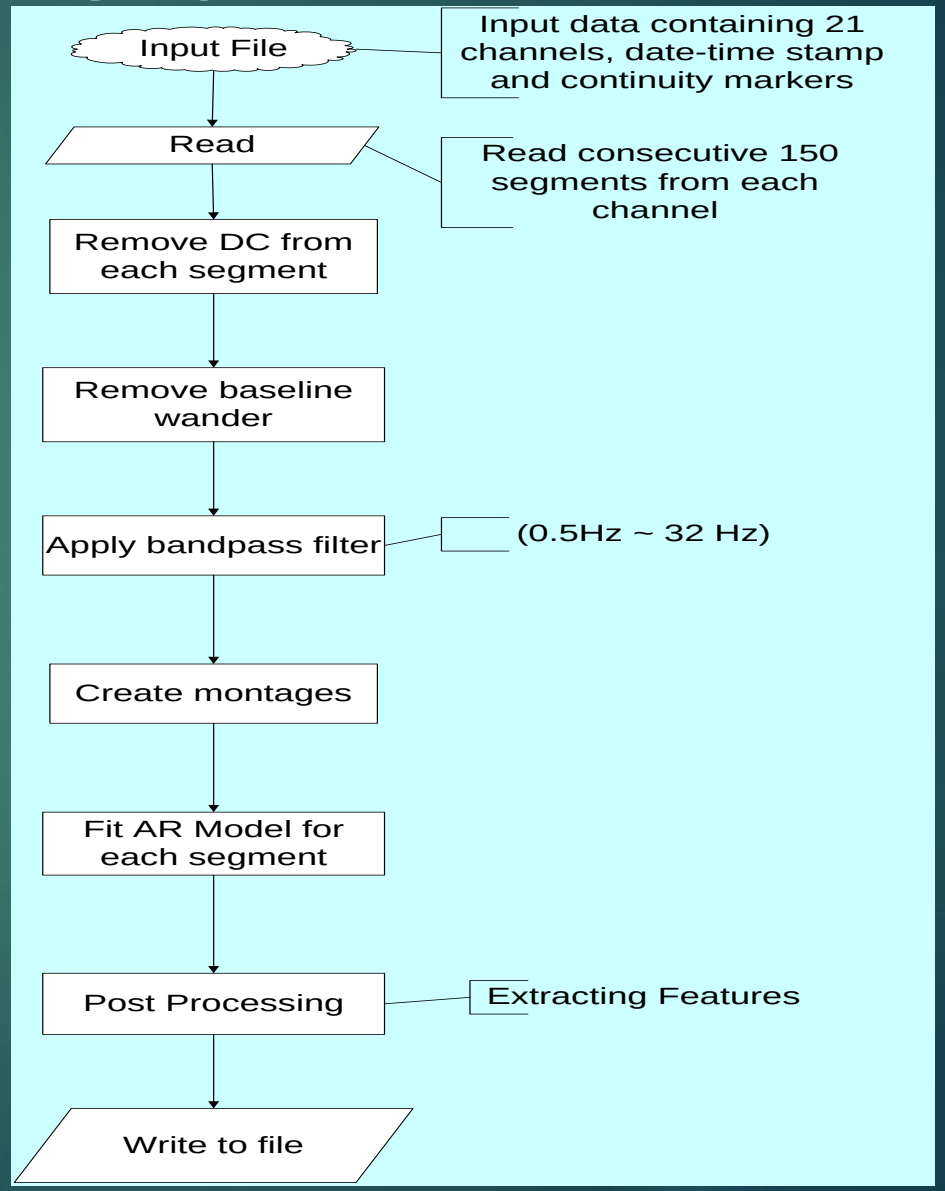
- SFR is calculated using the following equation in the Alpha band

$$SFR = \frac{e^{((\sum \log(S_f))/N)}}{(\sum S_f)/N}$$

  - Numerator is the geometric mean of the power spectrum (expressed in dB), and
  - Denominator is the arithmetic mean of the power spectrum (expressed in dB)

- Feature extraction -

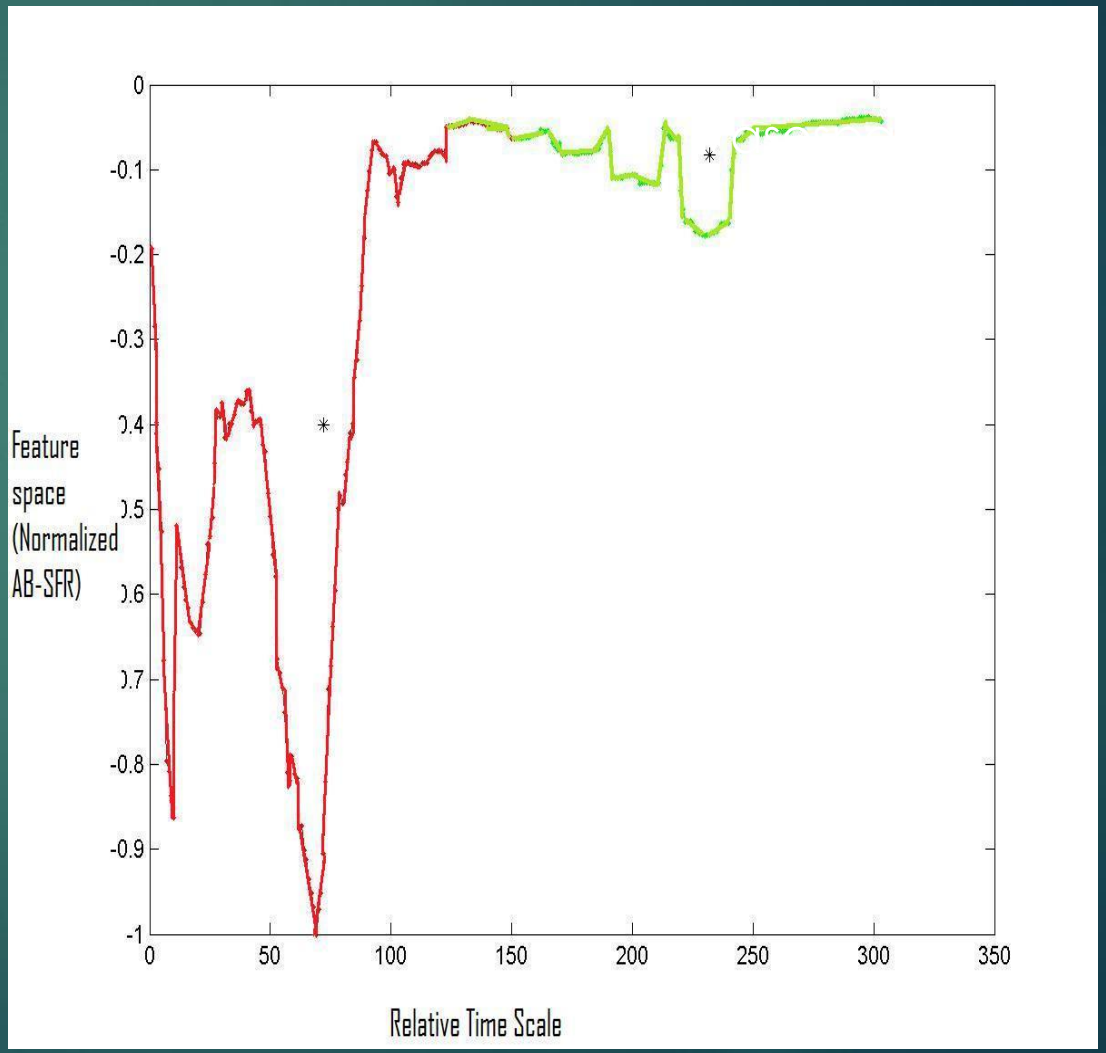
- Pre-processing
  - Data are read and segmented
  - DC is removed
  - Trend is removed
  - Data are filtered
  - Montage created
- Post-processing
  - AR model is fitted
  - AB-SFR is calculated
  - Result is saved



- Classification -

- Fuzzy C-mean clustering is used
- Maximum cluster distance in feature space is used to identify montage
- Class closer to 0 dB is used to detect onset of vasospasm

Clustered data of a sample montage



- Evaluation -

- Goodness of fit using Chi-Squared Test
  - Uses *TPF* and *TNF*
- Test for existence of two groups
  - Uses *Students-T test* on *AB-SFR*
- Margin of Error

$$E = Z\alpha\sqrt{\frac{p(1-p)}{n}}$$ †

where

n is the sample size,

p is the classification accuracy, and

$Z\alpha$ = 1.96 at 95% confidence interval

† Triola MM, Tiola MF, Biostatistics for the biological and health sciences, Pearson Addison Wesley, Boston, 261, (2006)

- Results -

- Classification results in identifying 10/12 vasospasm segments and 10/12 non-vasospasm segments
  - $Chi^2_{calculated}$ with Yates correction is 0.45 is less then $Chi^2_{critical}$ (3.84). Therefore classification accuracy is good
  - Students-T test on AB-SFR is 7.089 when $t_{critical}$ = 2.008 (2-tailed at p=0.95). Therefore AB-SFRs are from two different groups
  - Margin of error is 30%

- Discussion -

- Margin of error will be reduced as more patient data become available
- Cepstrum, AR coefficients and composite features may improve quality of classification
- Improve algorithm ‘intelligence’
  - Using clinical data like age, sex, neurological symptoms
  - Continuous monitoring may replace need for TCD

- Conclusion -

- Quantitative analysis to detect onset of vasospasm
  - Algorithm may be integrated with any EEG system
  - Automatic warning system may be implemented
- Simple non-adaptive high resolution spectral analysis may be sufficient

Raihan S[1], Sharpe MD[2], Parsa V[1], Young GB[2] & Ladak HM[1]

[1] The University of Western Ontario, London, ON, Canada

[2] London Health Sciences Centre, London, ON, Canada